

Posters 2010 Humboldt County Fair

“What’s Up With Our Crazy Planet – Lessons of the Earthquakes and Tsunamis of 2009 and 2010.”



The 2010 Humboldt County Fair Earthquake – Tsunami Room ran from Aug 12 - 22 and featured posters about the September 2009 Samoa tsunami, the January 2010 Eureka and Haiti earthquakes, the February 2010 Chile earthquake and tsunami, and the April Baja earthquake

The Most Important Take-Away Message



Protecting yourself from injury during the earthquake is where it all begins. You can't evacuate if you are incapacitated by the shaking!



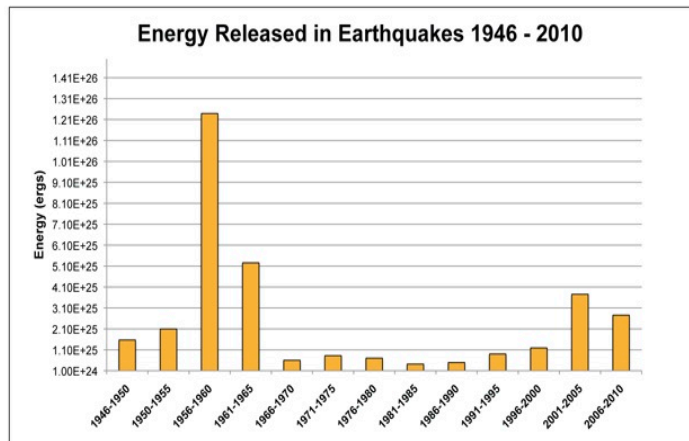
As soon as it is safe to move, get your "grab and go" kit and walk to high ground or inland away from the coast. Take the time to put on shoes as debris may make walking hazardous. Use tsunami hazard zone signs to guide you to a safe area.



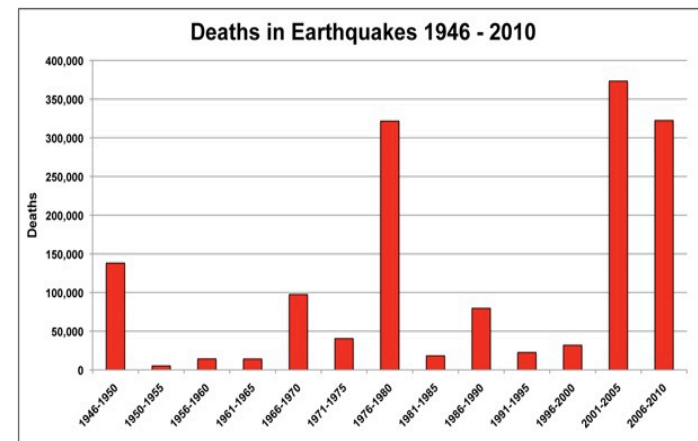
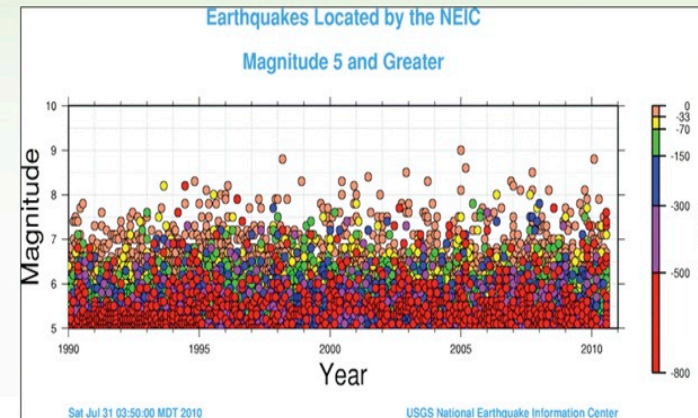
Tsunamis are TRICKY! Just when you think the waves are done, another damaging surge may arrive. The largest waves may arrive many hours after the first. Stay away from the coast until officials say it is safe to return.

Are Earthquakes Increasing? NO!

Samoa, Northern California, Haiti, Chile, China, and Baja – it may seem like earthquakes are on the rise. But the number and size of earthquakes is not much different than in the past.



The best way to measure earthquakes activity is by the energy released. The decade between 1956 – 1965 was much more active than recent decades.



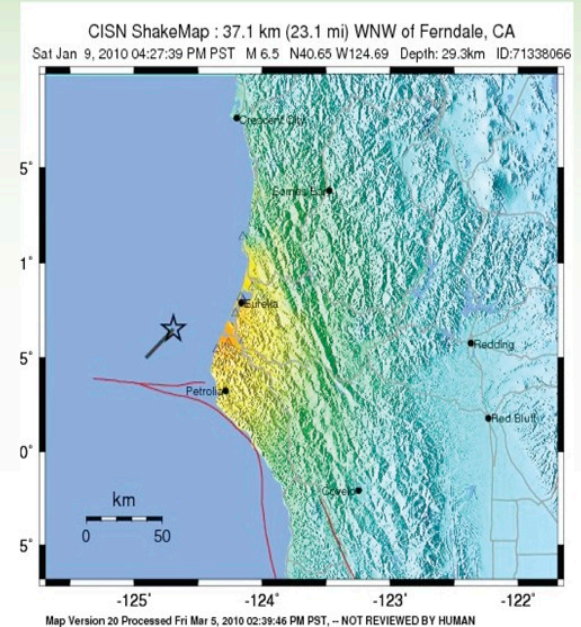
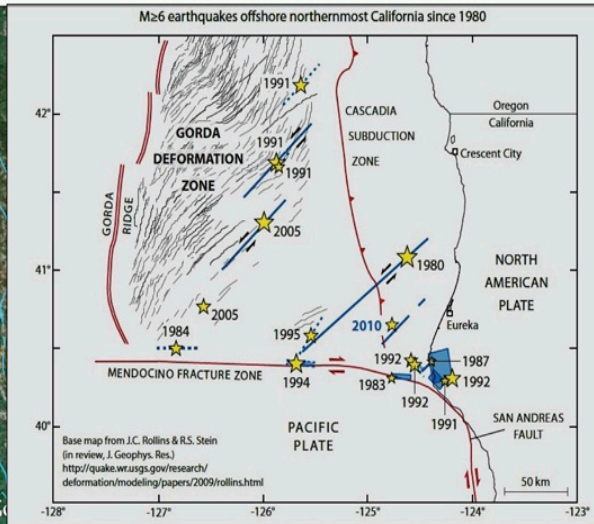
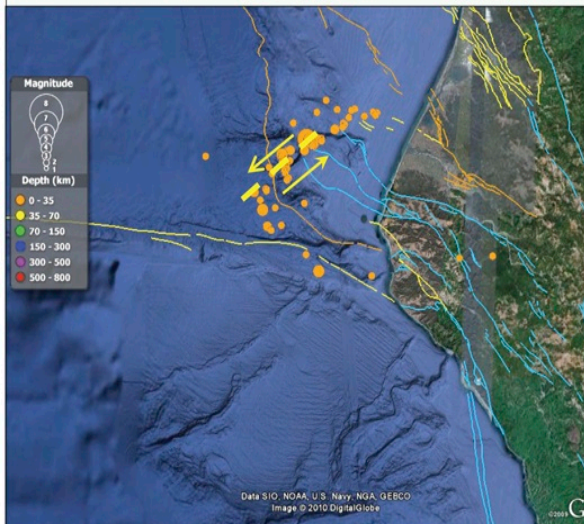
Earthquake casualties don't correlated with the energy released! Casualties may be on the rise because of increased population and more people living in vulnerable places.

January 9 Offshore North Coast Earthquake

Saturday 4:27 PM PST Magnitude 6.5

~\$30 million in damages

1 serious injury



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC. (m/s ²)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL. (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

The earthquake was felt throughout Northern California. 40,000 people experienced very strong ground shaking (intensity VII or greater) – strong enough to topple chimneys).

January 9 Damage to Structures

Eureka: Over 800 buildings damaged; 10 buildings with major damage



Chimney damage



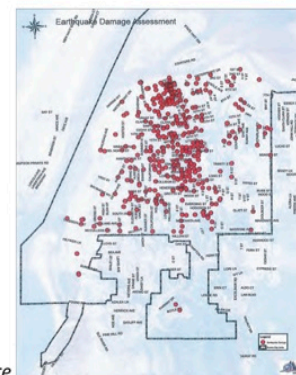
Cripple wall failure



325 2nd Street, Old Time Bar and Grill



Eureka was the most heavily damaged area. Most of the damage was minor such as broken windows and cracks in plaster. Almost 100 chimneys were damaged in the Eureka area. Some damage to structures also occurred in Ferndale, Loleta, and Fields Landing. Ferndale structures strengthened after the 1992 earthquakes and had very little damage.



Right: Buildings reported damaged in Eureka as of January 13, courtesy Eureka Fire

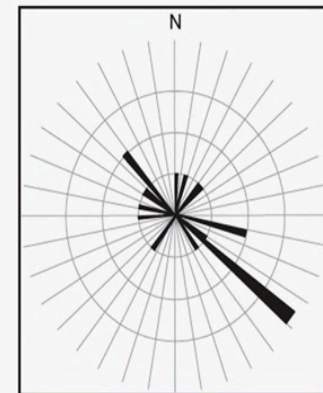
January 9 Non-structural Damage

Items falling from shelves, toppled and displaced furniture, broken glass, and falling ceiling tiles were some of the common non-structural problems.



January 9 Displaced Cemetery Monuments

Ground shaking was strong enough to displace monuments in Ferndale, Loleta, and Eureka more than half the monuments at the Ferndale cemetery were toppled, rotated or displaced. The monuments in Ferndale have had a difficult history. Most were knocked over in the 1906 earthquake and many were toppled again in 1992.

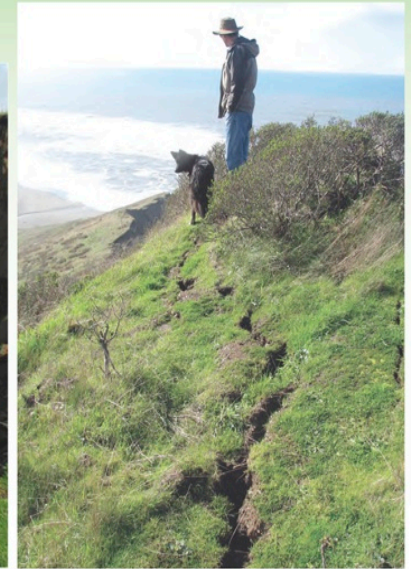


How the monuments moved - the majority moved to the Northwest or Southeast

January 9 Liquefaction and Landslides



Sand boils at Centerville Beach and on banks of Eel River



Bluff failure and cracks south of Centerville Beach



Spread failures north of the Eel River mouth



Spread failures at King Salmon

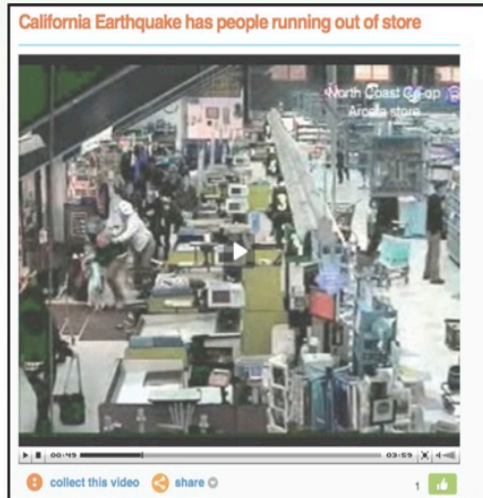


Mattole Road south of Ferndale

What some People did January 9 was **wrong**

Walking or running outside only increases your chances of getting hurt

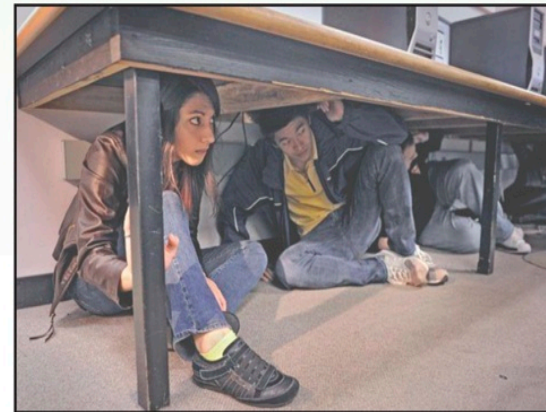
What some people did:



Response Description	#	Percent
Run outside	27	10.6%
Walk outside	28	10.9%
Drop, cover, hold-on	31	12.1%
Move to doorway	63	24.6%
Stay in one spot	79	30.9%
Took no action	28	10.9%

Results of a survey on what people did during the earthquake

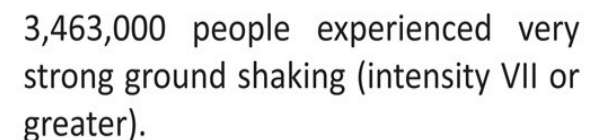
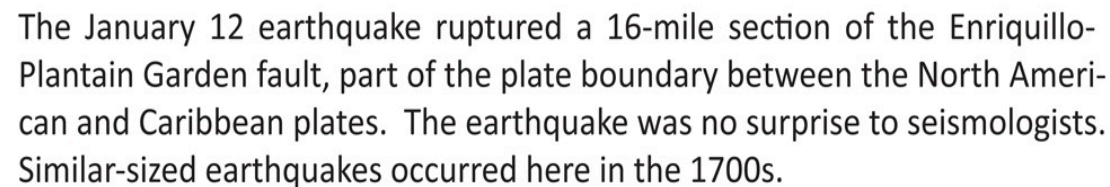
What they should have done:



Drop - Cover - and Hold On is still the best advice

Have you received an email about the so-called “triangle of life”? Treat it as spam - it has no support from first responders, earthquake engineers and other emergency professionals. Find out more in [Living on Shaky Ground](#) or at [ShakeOut.org](#).

At least \$2-3 billion in losses (30 - 50% gdp)



What Went Wrong in the Haiti Earthquake

Just about everything!



Presidential Palace, Port-au-Prince



On the streets of Port-au-Prince three days after the earthquake

Haiti had no building codes. Some buildings had been built to standards similar to those in California and withstood the shaking with little or no damage. But most buildings had no strengthening to resist earthquakes and the quality of construction materials was poor.

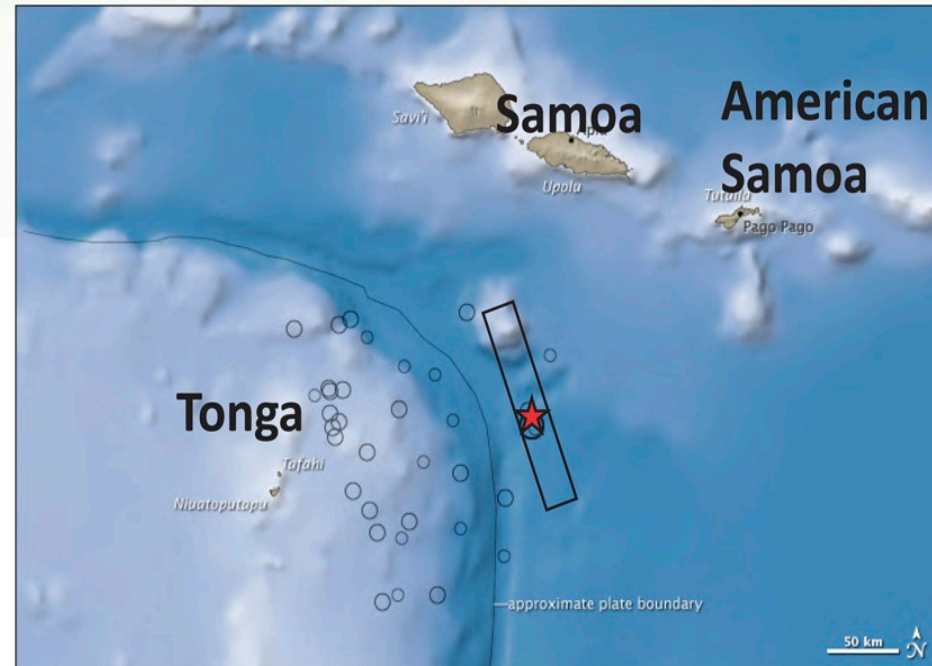
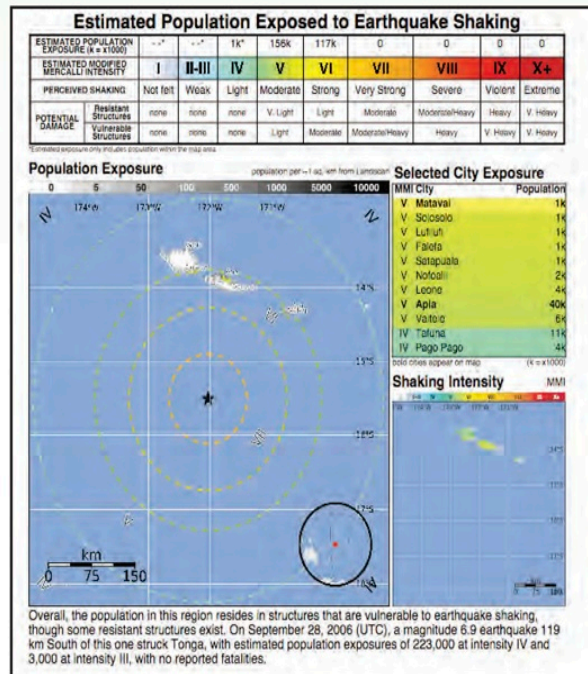
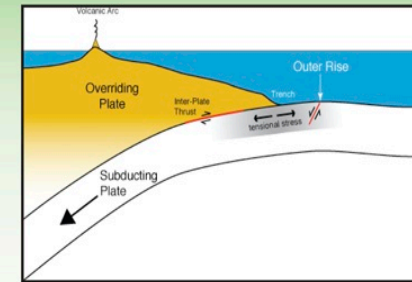
Six months after the earthquake 98% of rubble had not been removed.

September 29 Samoa Earthquake

Tuesday 6:48 AM (Samoa time)

Magnitude 8.1

192 deaths (34 American Samoa, 149 Samoa, 9 Tonga)



The Samoa earthquake was the strongest to strike the region in historic times. Although related to the Tonga subduction zone, the earthquake ruptured a normal fault within the Pacific plate, caused by the bending of the plate as it begins to subduct. The earthquake shaking did relatively little damage. All of the casualties and damage was caused by the tsunami.

Lessons from the Samoa Tsunami

1) Don't evacuate by car



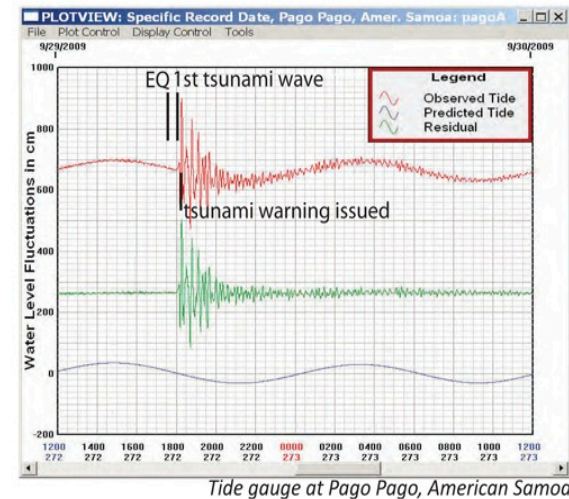
2) Don't wait for an "official" warning

Earthquake: 6:48 AM

Tsunami arrived at Pago Pago 7:02 AM

First tsunami bulletin issued at 7:04 AM

The ground shaking is Mother Nature's warning!! It is the first warning, and possibly the only one, that you will receive.



Planning and Action in Samoa saved lives



The Mayor of Amenave notified people with his bullhorn



People rang school and church bells



Sinalei Resort had a private siren system and trained staff

Some schools practiced tsunami evacuation drills.

Signs and tsunami education programs had been adopted in some areas



February 27 Chile Earthquake

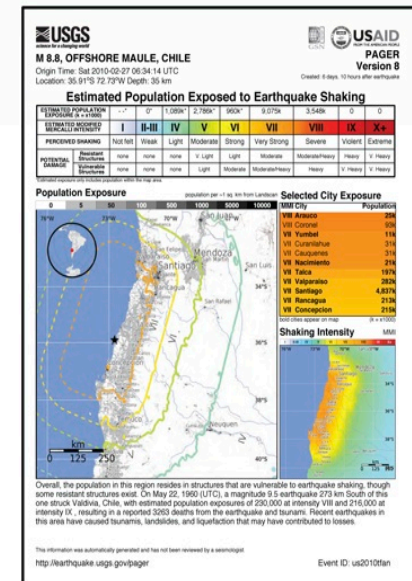
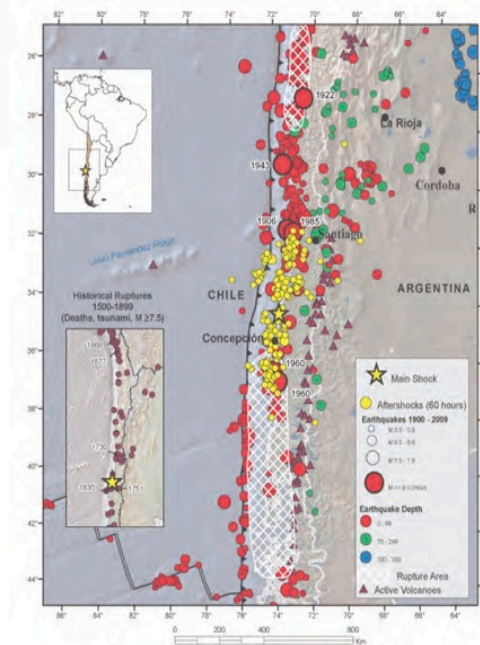
Saturday 3:34 AM Local time Magnitude 8.8

521 people killed, 56 missing, (124 attributed to the tsunami)

370,000 homes destroyed

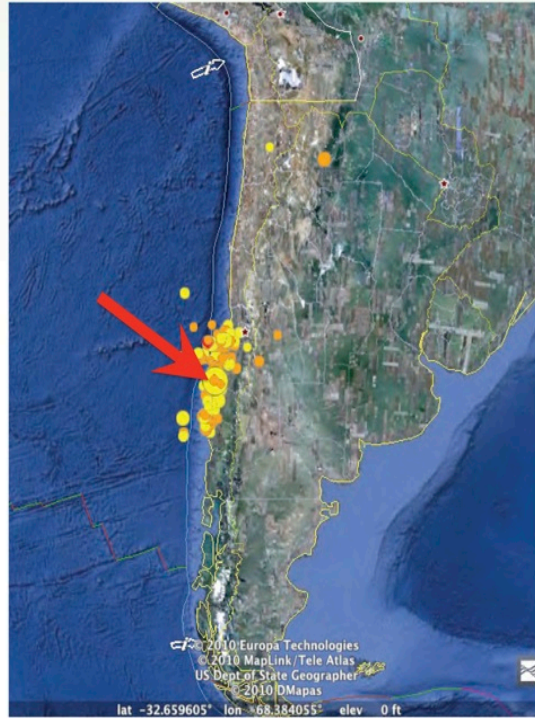
~ \$30 billion (US dollars) in losses (30% gdp)

The earthquake was no surprise. Chile has experienced at least 20 earthquakes of magnitude 7.5 or larger since 1900. The 1960 magnitude 9.5 Valdivia earthquake, shown by the white cross-hatch pattern, is the largest earthquake known in modern times.

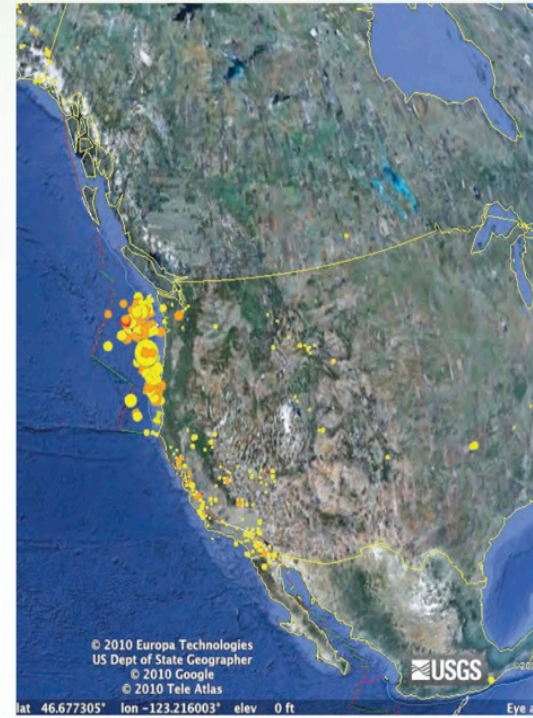


12.5 million people experienced very strong ground shaking (intensity VII or greater), four times as many as in Haiti.

Why the Chile Earthquake is Important to Northern Californians



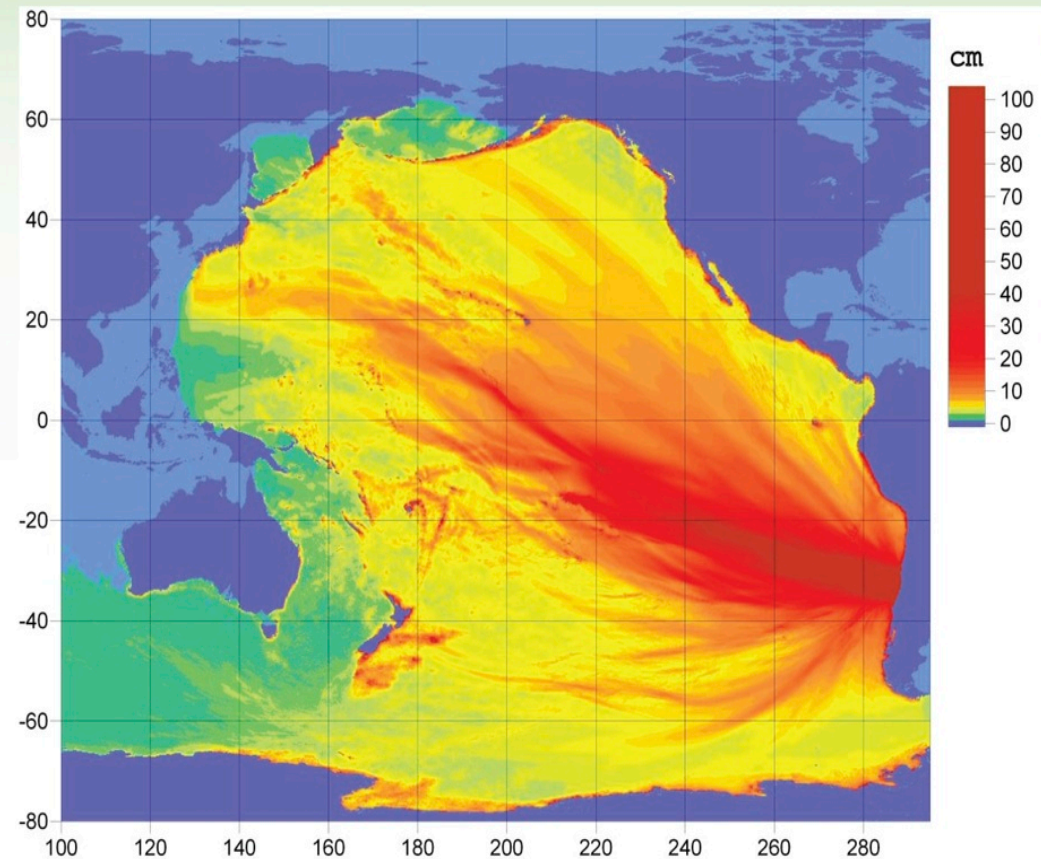
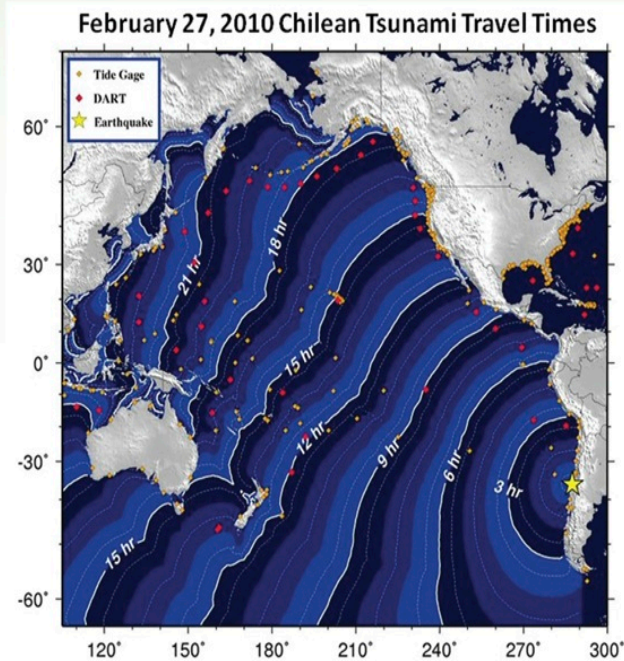
Mainshock (arrow) and aftershocks the first week afterwards



The Chile earthquake sequence superimposed on the Cascadia subduction zone

The Chile earthquake is the same size and type that we expect to occur on the Cascadia subduction zone, the major fault system that lies along the coast of Northern California, Oregon, Washington and southern British Columbia. Chile is a modern country with building codes and infrastructure very similar to ours.

The Chile tsunami affected the entire Pacific basin



The image to the left shows the time it took for the first waves to travel from the source region in Chile to other areas in the Pacific. The first surges arrived along the central Chilean coast in less than 15 minutes after the earthquake. The waves took almost a day to travel to Japan.

The Image on the right is the modeled peak amplitudes of the tsunami surges. Images from NOAA.

Impacts of the Chile Tsunami in California

The first tsunami surges arrived on the Southern California Coast nearly 14 hours after the earthquake

- A Tsunami Advisory was issued for the California coast about three hours after the earthquake and more than ten hours before the first surges arrived.
- An Advisory means that beaches, harbors, dock areas will be hit with strong currents. There is no danger of flooding on dry land.

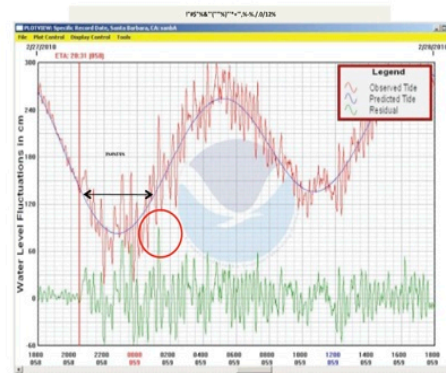
The tsunami caused several million dollars of damage in Southern California



Shelter Island, San Diego harbor during and after the tsunami. The currents pulled boats away from docks and damaged structures in the water.



The tsunami made tidal flooding worse at Seal Beach the following day.



Water level recording (marigram) at Santa Barbara. The largest tsunami waves arrived about six hours after the first surge and continued on for a day.



Damage in Ventura harbor.

Lessons from the Chile Earthquake

Don't Forget to Educate Inland Residents

Coastal residents were very aware of earthquakes and tsunamis but inland residents were not. The earthquake happened on the last weekend of summer - the equivalent of our Labor Day weekend. Beaches and coastal campgrounds were packed with out-of-the-area tourists. At least 30 people may have died at this campground in Curanipe. No information about what to do in an earthquake was proved to campers.



Lessons from the Chile Earthquake

Education Works!



Many people, like this fisherman, remember past earthquakes



Children and staff practice evacuation drills



Coastal Chileans are very aware of the hazards posed by earthquakes and tsunamis. Coastal schools practice drills and children are taught to recognize ground shaking is the warning to evacuate. Many towns have posted tsunami signs. Educational material in both electronic and print form is widely available.

Lessons from the Chile Earthquake

Be Prepared to be on Your Own for at least a week
Earthquake Engineering works



Roads, bridges, power, and all government services were disrupted for more than a week in most areas. For four days, people were completely on their own even in large cities.



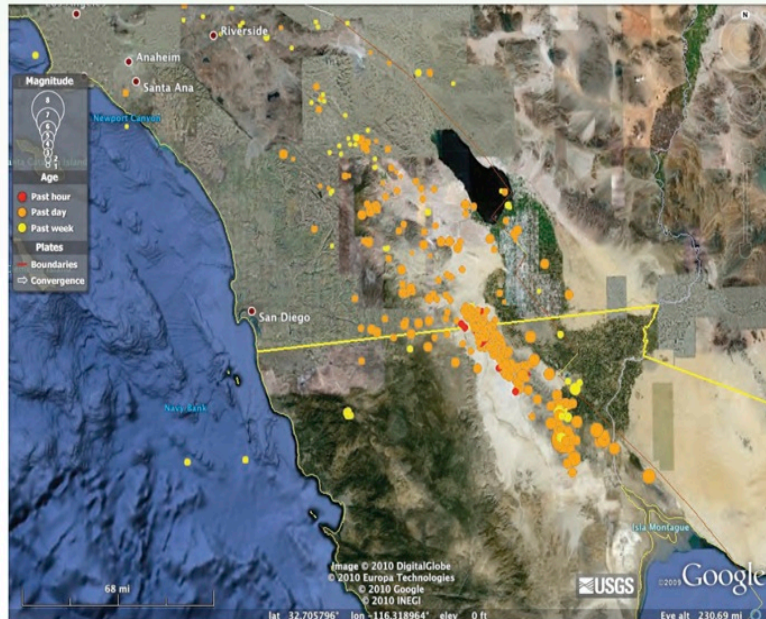
Concepción: Well-built structures designed to resist shaking performed very well. Weak buildings collapsed. The high rise building in the background suffered very little damage while the adobe brick building in the foreground was destroyed.

April 4 Baja (Sierra el Mayor) Earthquake

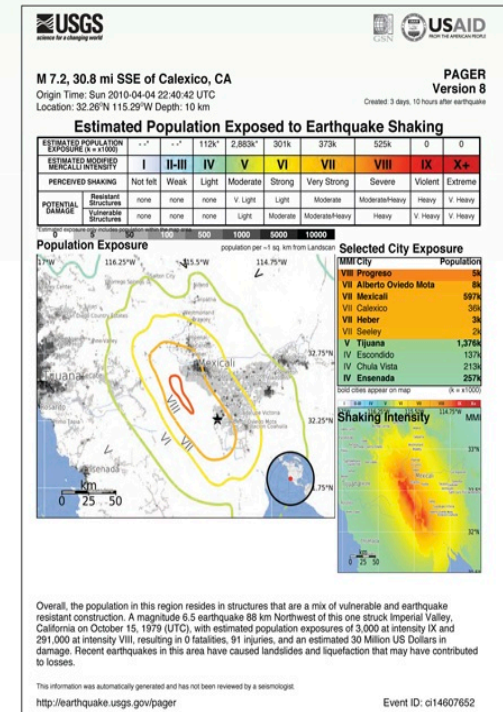
Sunday 3:40 PM Local time Magnitude 7.2

2 people killed, 230 injured

~ \$425 million (Baja), \$91 million (California) in losses



The April 4 (Easter) earthquake ruptured a 60-mile section of fault associated with the plate boundary between the Pacific and North American plates. This is the transition zone between the strike-slip San Andreas fault system and the spreading center in the Gulf of California. It was the largest earthquake in this area since 1892.



900,000 people experienced very strong ground shaking (intensity VII or greater).

Lessons from the Baja Earthquake

Strongest shaking was in an uninhabited area

We dodged a bullet!



Train tracks were bent by ground movement



Dust excited by the ground shaking



Roads were particularly vulnerable



Over 60 miles of surface fault rupture

Participate in the Great California ShakeOut!!

October 21, 2010 at 10:21 AM

<http://shakeout.org/>



Join millions of Californians in practicing Drop - Cover - Hold On

Why participate in the ShakeOut?

- Develop the “muscle memory” to do the right thing when the real ground shaking starts
- Get helpful tips on how to make your home and community earthquake/tsunami resilient
- Talk to your family, friends, and co-workers on preparing for earthquakes and other disasters
- Preparing for earthquakes prepares you for other emergencies

Practice makes Perfect:

Northern California's Tsunami drills and tests

On Wednesday March 24, 2010, Del Norte, Humboldt, and Mendocino Counties participated in a "Live Code" Tsunami Warning System Test.



Over 800 Del Norte County residents participated in a full-scale tsunami evacuation drill – the largest tsunami drill ever held in the United States!

Next Drill Wednesday March 23, 2011



*School children practice evacuation in Crescent City
Photo courtesy The TriPLICATE*